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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
PALABRICA, RICARDO J	

ART UNIT	PAPER NUMBER
3663	

MAIL DATE	DELIVERY MODE
11/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/720,035	TSANG ET AL.	
	Examiner	Art Unit	
	Rick Palabrica	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 October 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *23-29 and 79-82* is/are pending in the application.

4a) Of the above claim(s) *26* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *23-25, 27-29 and 79-82* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114.

Applicant's submission filed on 10/11/07, which directly amended claim 23, canceled claims 1-22 and 30-78, added new claims 80-82, and traversed the rejection of claims in the 7/31/07 Office action, has been entered. The matter regarding the drawing objection in said Office action is resolved.

Applicant's arguments with respect to the rejected claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 23-25, 27-29, and 79-82 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

In the specification, applicant states large scale electrical energy generation as the object of his claimed invention, as evidenced by the following statements:

> *"More specifically, it is an object of the present invention to provide a self-contained method and apparatus for converting nuclear power to electrical power that can generate large amounts of electrical power for long periods of time without the need for frequent refueling and require little or no maintenance. Another object of the present invention is to provide a method and apparatus that meets the long felt need for a method of converting nuclear energy to electrical energy that is small in*
> *size, reliable and can generate large amounts of electrical energy for use in submarines, surface ships, and as a battery to power a whole range of products--including, for example, military equipment, satellites and space vehicles." Underlining provided. See paragraph bridging pages 5 and 6.*
>
> *"The present invention is very adaptable because multiple nuclear voltaic cells--comprising any of the embodiments described above, i.e., embodiments 1, 2, 3, or 4--may be linked together to form a critical array, described as embodiment 5 above, to provide power up to and exceeding the megawatt range." Underlining provided. See page 9 of the specification.*

As applicant himself admits, his invention is designed for high capacity electricity generation for transmission and distribution, and/or for powering large transport vehicles (e.g., submarines and ships). Any one of these claimed applications require a system equivalent to a nuclear power plant in the range of about 1000 Megawatts. In fact, applicant highlights the high conversion efficiency and low maintenance requirements of his claimed invention over other techniques of converting nuclear energy into electrical energy, including nuclear power plants and solid semiconductors. For example, applicant states:

> *"Theoretically, the best methods for converting nuclear energy into electrical energy should be direct methods where the nuclear energy is directly changed into electrical energy. The nuclear power plant discussed above involves an indirect, two-step process in which the nuclear energy is transferred into thermal energy that causes water to turn to steam that is used to drive turbines and create electrical energy. Direct conversion methods are potentially the most efficient conversion methods because they would avoid the inherent energy loss during each conversion process.." See paragraph 0012 of the specification.*

> *"The potential conversion efficiency of the solid semiconductor system is high. However, the solid semiconductor method of converting nuclear power cannot be used to produce large power outputs for extended periods of time because the high energy radiation that enters the solid semiconductor also causes damage to the semiconductor lattice. Furthermore, if the energy source is fissile material, some of the fragments of fissile material that enter the solid semiconductor remain in the solid semiconductor. The introduction of trace amounts of defects, including native and impurity point defects and extended defects, can significantly reduce semiconductor device performance. Over time the solid semiconductor is degraded and efficiency decreases until it is no longer useful for power conversion. Consequently, even though systems using solid semiconductors as direct converters of nuclear energy to electrical energy are potentially very efficient, they are often impractical for high power, long duration applications." See paragraph 0014 of the specification.*

Notwithstanding all this claimed novel and superior features of the invention, the specification provides nothing more that the following short description of the claimed embodiment:

> *"In another preferred embodiment, the present invention may also be used to construct a nuclear voltaic battery. In Embodiment 8, described above, the nuclear material in the form of a radioactive isotope is dissolved in a liquid semiconductor. Dissolving the radioactive isotope in the liquid semiconductor is a preferred embodiment of the invention, however, in another embodiment the radioactive isotope may instead be positioned in close proximity to the liquid semiconductor. Nuclear energy in the form of alpha, beta, and/or gamma radiation enters the liquid semiconductor and creates electron-hole pairs. The liquid semiconductor is an n-type or p-type semiconductor that is sandwiched between two metal contacts that are selected so as to create a Schottky diode and a low resistance or Ohmic contact when placed in contact with the n-type or p-type liquid semiconductor. A built-in field is produced within the depletion region of the liquid semiconductor that causes electrons and holes generated either in the depletion width or within a few diffusion lengths of it to move in opposite directions. This results in the generation of a current. By placing a load on the contacts of the present invention electrical power is generated. In a preferred embodiment, the nuclear voltaic cell is constructed by wrapping the layers of materials around a mandrel in a spiral fashion." See paragraph 0042 of the specification.*

There is neither an adequate description nor enabling disclosure as to: a) what are the minimum voltage and current to form a working nuclear voltaic cell (e.g. to generate a 1000 megawatt power); b) what level of purity is required for the liquid semiconductor (i.e., prior to introduction of chalcogen material); c) what are the

temperature, flow and pressure levels of the system; d) what should be the volumetric or weight ratio of chalcogen to the liquid semiconductor; e) how and in what manner is it assured that nuclear decay products are sufficiently removed by the scrubber from the liquid semiconductor to minimize radiation damage (note that the ability to "self-heal" is an attribute of a liquid semiconductor that applicant alleges as a distinct advantage over solid semiconductors, and therefore minimizing radiation damage is critical to the invention); f) what is the required minimum enrichment for the chalcogen.

It is thus considered that the examiner (for the reasons given above) has set forth a reasonable and sufficient basis for challenging the adequacy of the disclosure. The statute requires the applicant itself to inform, not to direct others to find out for themselves; In re Gardner et al, 166 U.S.P.Q. 138, In re Scarborough, 182 U.S.P.Q. 298. Note that the disclosure must enable a person skilled in the art to practice the invention without having to design structure not shown to be readily available in the art; In re Hirsch, 131 U.S.P.Q. 198.

3. Claims 23-25, 27-29, and 79-82 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The means scrubbing the liquid semiconductor of nuclear decay products is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Note that scrubbing and purifying the liquid semiconductor is critical to the claimed invention, as applicant himself admits in the following statement:

"The introduction of trace amounts of defects, including native and impurity point defects and extended defects, can significantly reduce semiconductor device performance. Over time the solid semiconductor is degraded and efficiency decreases until it is no longer useful for power conversion. See paragraph 0014 of the specification.

4. Claims 23-25, 27-29, and 79-82 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: means for that scrubbing and purifying the liquid semiconductor.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 23-25, 27-29, and 79-82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mannik et al. (U.S. 5,859,484) in view of Greuter (J. Phys. C:Solid State Phys. 18(1985)). Mannik et al. disclose the applicant's claim limitations except for the liquid form of selenium.

As to claims 23, 24, 80 and 81 Mannik et al. teach a nuclear battery formed from a crystalline semiconductor that incorporates a radioisotope such as tritium. The crystalline semiconductor material includes selenium (see Fig. 1 and col. 6, lines 20+, and 45+). They further teach in Fig. 1 a crystalline semiconductor 12 that can be a homostructure, wherein layers 14 and 16 are the same material (e.g., see col. 12, lines

52+). They also teach an embodiment shown in Fig. 2 wherein the semiconductor has a Schottky barrier structure (see col. 5, lines 28+).

Greuter teaches that selenium is an electronic semiconductor that has a crystalline structure when it is in a liquid state near its melting point (see page 2527, Section 1).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the process, as disclosed by Mannik et al., to provide selenium in a liquid state, to gain the advantages thereof (i.e., provide a semiconductor material with the appropriate crystalline structure), because such modification is no more than the use of a well known expedient within the nuclear art.

As to claim 25, Mannik et al. teach the use of either a p-type or an n-type semiconductor (see col. 6, lines 14+).

As to claim 28, the limitation, "liquid semiconductor flows through said channel" is a process limitation that occurs when the claimed apparatus is exercised or made operational. This clause, as well as other statements of intended use, does not serve to patently distinguish the claimed structure over that of the reference, as long as the structure of the cited references is capable of performing the intended use. See MPEP 2111-2115.

See also MPEP 2114 that states:

> A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647.

> Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531.
>
> [A]pparatus claims cover what a device is, not what a device does." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 15 USPQ2d 1525,1528.

As set forth in MPEP 2115, a recitation in a claim to the material or article worked upon does not serve to limit an apparatus claim.

The cited reference is capable of being used in the same manner and for the intended or desired use as the claimed invention. For example, during the assembly of the device of Mannik et al., the liquid organic semiconductor has to be filled in the container. The liquid semiconductor flows through the channel between the electrodes until the container is filled. Note that it is sufficient to show that said capability exists, which is the case for the cited reference.

As to claim 29, applicant's claim language, "mandrel", reads on the enclosure that is inherently present in the Mannik et al.-Greuter combination in order to maintain a required volume of the liquid organic semiconductor.

As to claims 27 and 79, the use of nonconductive spacers between the first and second metal contact layers is a matter of design choice or optimization within prior art conditions or through routine experimentation (see MPEP 2144.05 II.A). Having such spacers would provide structural rigidity to the enclosure for the liquid semiconductor of Mannik et al., but would add to the cost of the device, and a proper balance between the competing factors have to be made.

As to claim 82 Mannik et al. teach the use of magnesium, selenium and tellurium for control of carrier diffusion in the semiconductor (see col. 4, lines 45+)

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rick Palabrica whose telephone number is 571-272-6880. The examiner can normally be reached on 6:00-4:30, Mon-Thurs.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

RJP
November 21, 2007

RICARDO J. PALABRICA
PRIMARY EXAMINER